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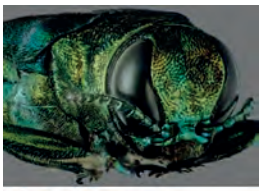
FORESTED WETLAND COMMUNITY DESCRIPTION AND ANALYSIS. A PRE-EMERALD ASH BORER STUDY IN AN ERA OF GLOBAL CHANGE

While with an eye made quiet by the power
Of harmony, and the deep power of joy,
We see into the life of things.
Wordsworth 1798

ABSTRACT

Trees in 11 900 m^2 plots at four headwater wetland sites (Elm Flats, Bonita Swamp, Frog Valley and Bentley) have been identified and measured for 9 years. At Elm Flats trees exhibited a hump-shaped basal area distribution with a high proportion of shade tolerant trees in the larger size classes. This is indicative of a forest that has been subjected to limited anthropomorphic disturbance and possibly retains some old growth characteristics. The older forests also had the richest understory flora. Trees at the other three wetland sites exhibited characteristics indicative of successional swamp forests. Early signs of forest change from the invasive insect, the emerald ash borer, which kills ash (*Fraxinus*) trees, the most common species in these swamps, are visible in the annual growth increments, tree mortality and canopy cover. This tree census data, in conjunction with the understory species cover data, will be used to assess the impact of non-native species invasions, in particular the emerald ash borer (*Agrilus planipennis*), and climate change on our forests.

Keywords: *forest, size class, swamps, non-native species, emerald ash borer.*



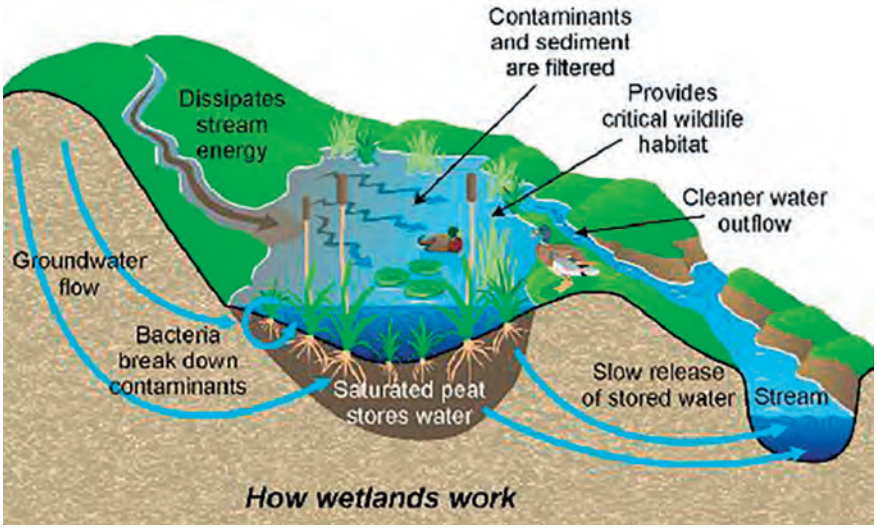
I am honored to be speaking to you today. The purpose of this talk is to share with the Ablakes community an insight into the nature and significance of research my field. This will focus on explaining the background, methods, purposes, and results of my scholarship and will also broaden the understanding of research being undertaken at Fredonia. I chose this topic because hopefully it is relevant and interesting to the Ablakes community.

I chose this topic because hopefully it is relevant and interesting to the campus and the community.

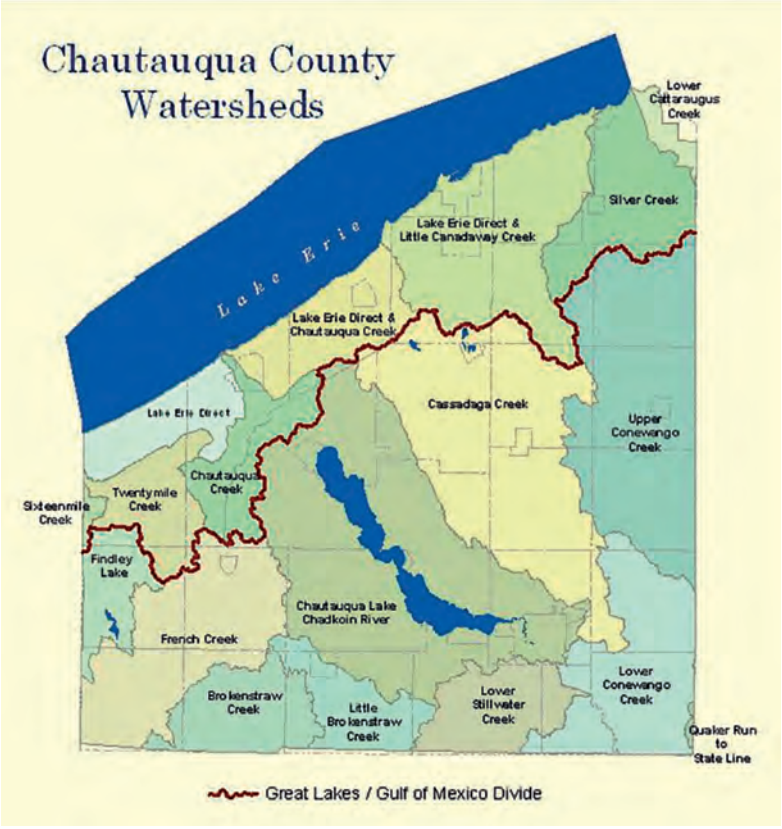
I have conducted research in many different places on many different topics but there is a common theme. All of my research projects have contributed to the research which I will speak about today. I will speak about my current research but I'll mention some previous research as well. First I would like to give you some background on forest ecology so when I give you my research it'll make more sense.

Chautauqua Lake
5180 ha Maximum depth 24m Residence time north basin 514 days
south basin 102 days

Highly developed shoreline Naturally eutrophic
Runoff and stream flow ~78% of water input
Lawn fertilization, Dairies, Sewage treatment plants, Algal blooms



Regulate water flow (reduce flooding)
Filter water
Preserve shorelines



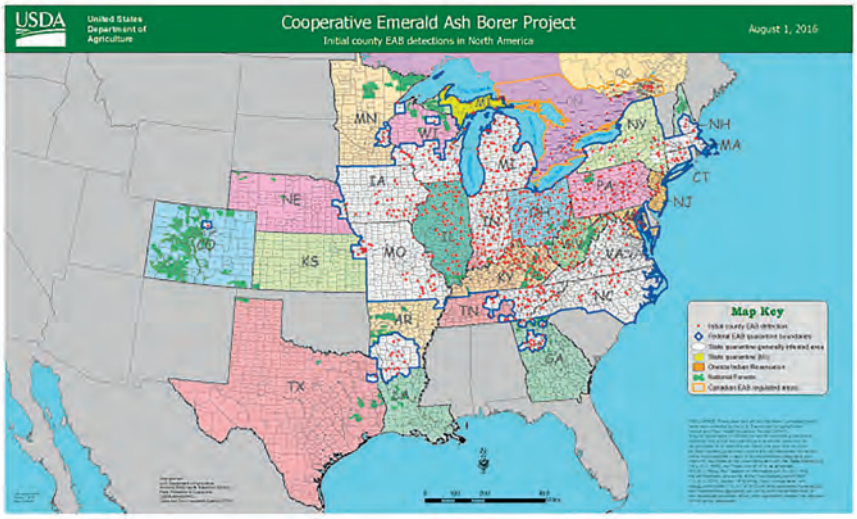
Bentley, 2015 flooding

Bonita swamp

Elm Flats

Frog Valley


E PLURIBUS UNUM
LIBERTY
IN GOD WE TRUST
FIVE CENTS
UNITED STATES OF AMERICA



Emerald Ash Borer (*Agrilus planipennis)*

- Non-native invasive species
- Rapidly infests all North American *Fraxinus* (ash) species -- 100% mortality in 2-4 years
- Larva feed on inner bark and interrupt the transport system of the tree
- D-shaped" exit hole as adults emerge from the bark
- Females lay eggs on the bark of ash trees. Larva bore through the bark and start eating, leaving "S"-shaped trails.

- Killed >400 million ash trees since 2002
- Spreads via firewood, ash logs, ash products, etc.
- ~20% of NYS is infested by EAB
- 900 million ash trees in NYS at risk (1/10 NYS trees are ash)

Forest Change – Beech Bark Disease

- European scale insect + native *Nectaria* fungi
- In the region for ~50 years
- Very slow killer
- ~10% of beech trees resistant – critical genetic stock
- Beech nuts – **the** critical protein source

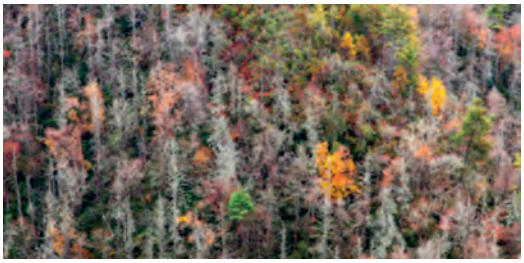


Forest Change – Hemlock woolly adelgid

Chinese "aphid" – 1951 in US
~1.5 mm long, red-brown or purple-black
Once hatched proceeds to feed at the needles
100% hemlock mortality in 4-10 years







Forest Change… Deer – voracious consumers. Vastly overpopulated – no predators.
ALL edible plants are gone from the forest understory.
Climate change: 1.4°C warmer than 1970.
Wetter winters, drier summers – 5% increase in precipitation.
More extreme events.
Winter is 1 week shorter. Ranges are shifting and phonological patterns are changing.

Methods

11 30m x 30m plots, trees tagged

DBH (>10 cm) Condition – esp. tree diseases

Vines Snags & dwd – tree death and dead wood dynamics

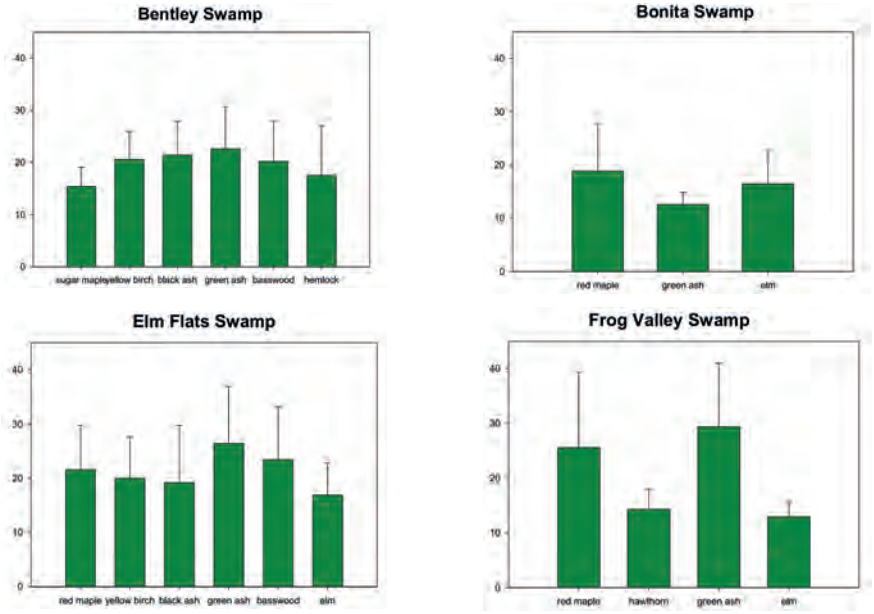
Understory – 4m x 4m quadrats (3 per plot)

Measure understory trees, shrubs, herbs by species, density, %cover, height

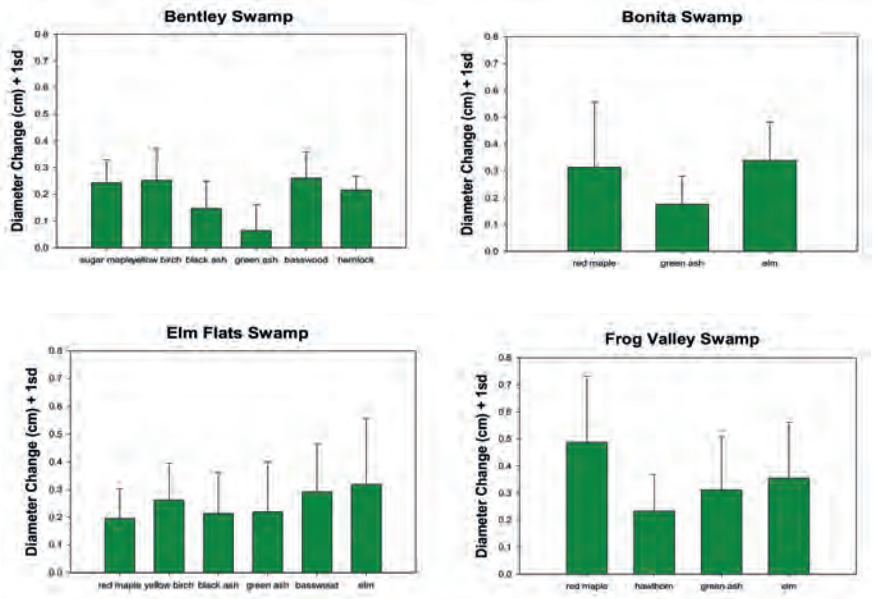
PERMANENT



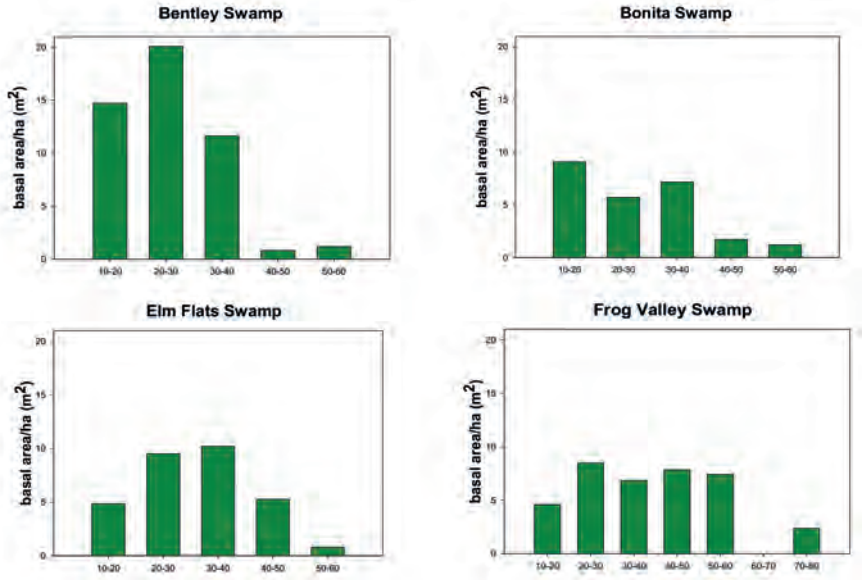
Mean diameter of major tree species in 4 swamps



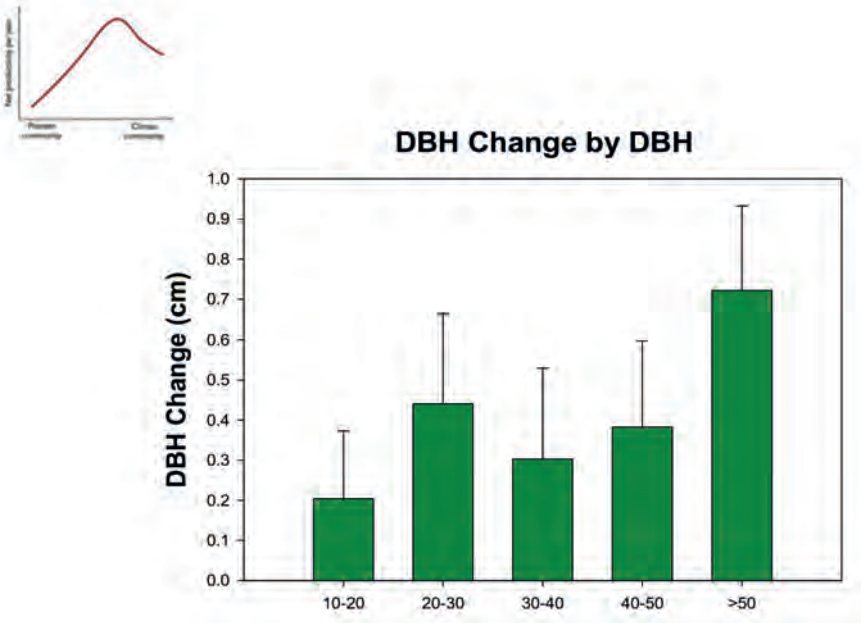
Mean annual diameter change in major tree species in four swamps 2009-2016



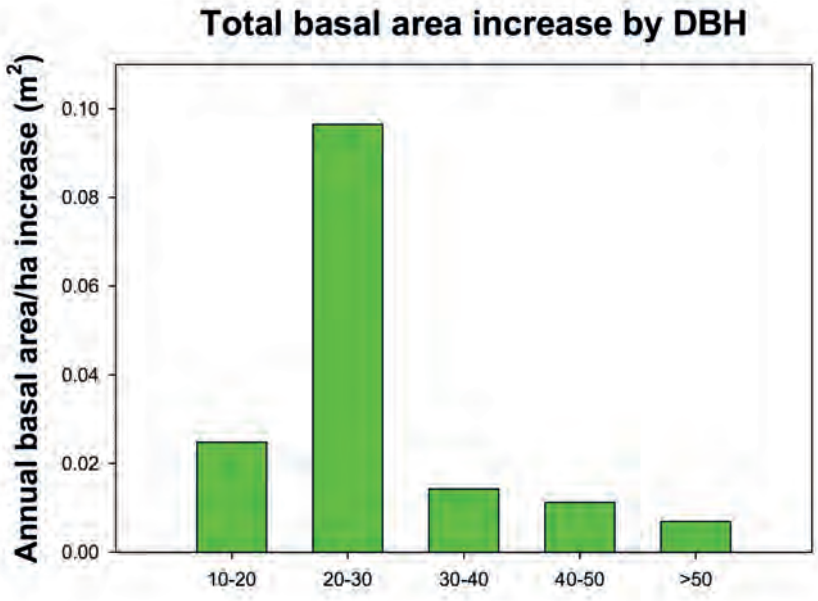
Total basal area by diameter in four swamps

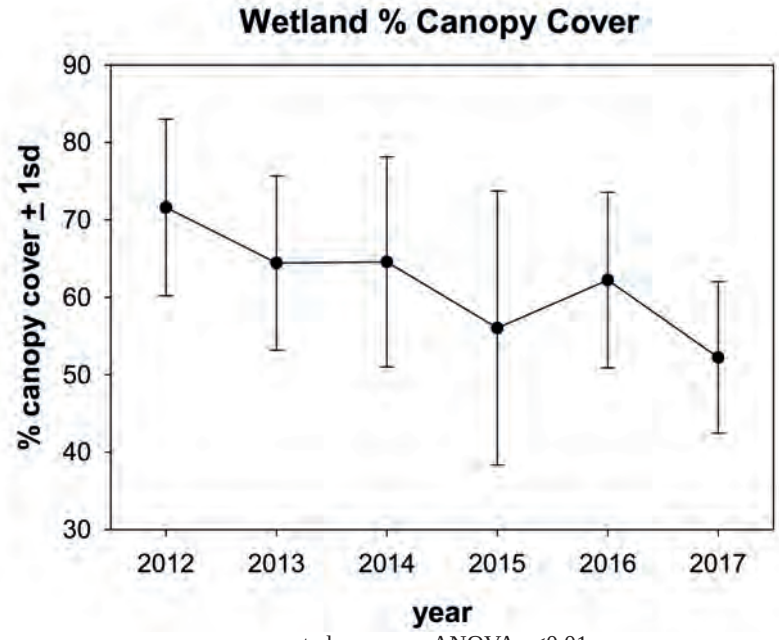


Mean annual diameter change in 10 cm diameter classes



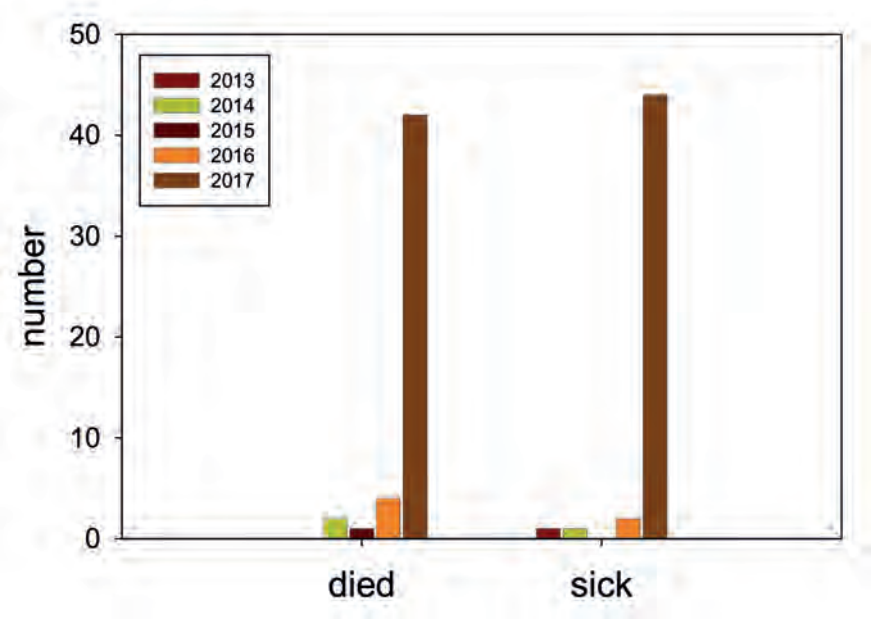
Total annual basal area increase in 10 cm diameter classes



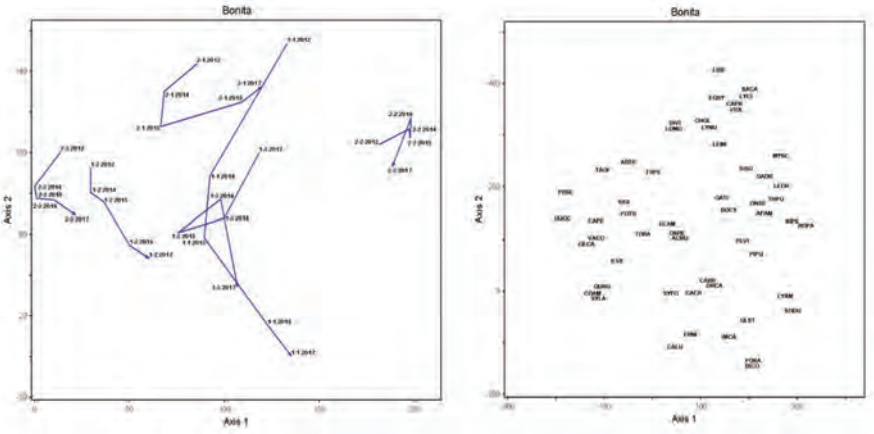


repeated measures ANOVA $p<0.01$

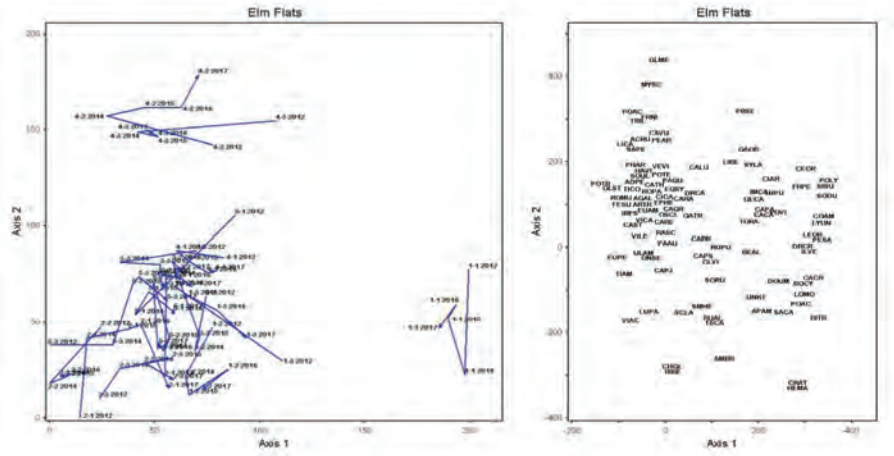
Number trees dying or becoming sick each year



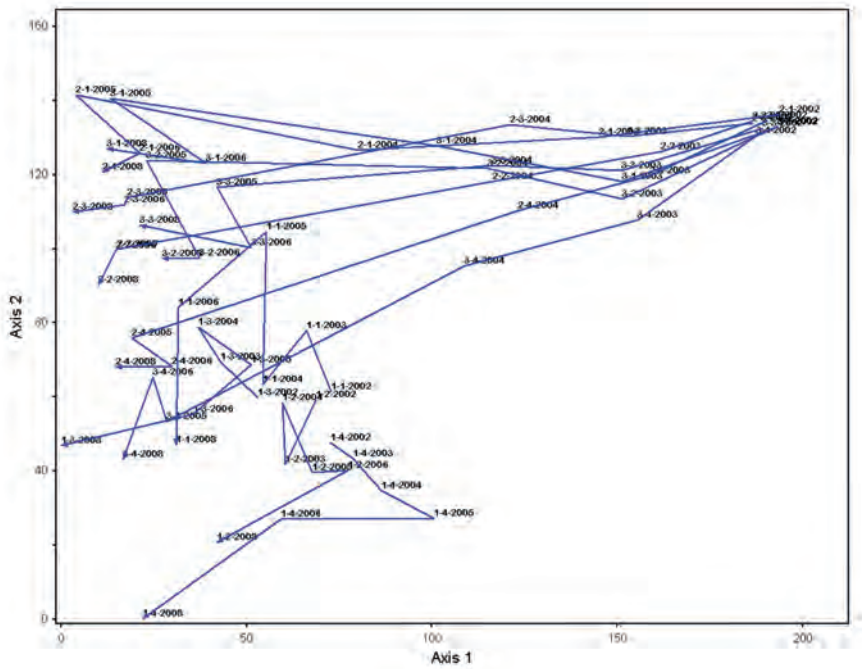
The understory:
Bonita 2012-2017



Elm Flats 2012-2017



Succession on Mount St Helens



A pattern is evident here unlike in the swamp understories.

Swamps

Swamp forest structure
Forests are maturing into old growth – let them
EAB will change these forested wetland communities…
No clear patterns yet in understory
The future… continue to monitor

ACKNOWLEDGEMENTS

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